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EFFECTIVE MAINTENANCE POLICY AS A TOOL FOR SUSTAINING HOUSING STOCK IN DOWNTURN ECONOMY

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Abstract

The study considered how effective maintenance strategies could serve as a tool for sustaining housing delivery in periods of economic recession. It identified the causes of neglect of maintenance responsibilities in some selected government institutions, ministries, parastatals and public estates within Lagos metropolis and to develop adequate maintenance implementation strategies for these buildings. In achieving these objectives, opinions of (30) randomly sampled maintenance officers of selected government institutions, ministries, parastatals, and occupiers of selected public estates were collected using structured questionnaires and personal interviews. Data analysis indicated that lack of discernible maintenance culture in the country; lack of emphasis on training, retraining and continuing education on effective maintenance by establishment are the major reasons for neglect of maintenance responsibilities. The study also revealed that majority of the population studied provides budgets for maintenance operation but this was found to be inadequate. The study recommended proactive approaches to maintenance by providing guidelines for maintenance checklist operations on key building elements, frequencies for maintenance operations, and operatives required for effective implementation.

Keywords: Proactive maintenance, Sustainable housing, Maintenance policy, Depressed economy.

Introduction

Improved housing policies and programmes are a major component of achieving the goal of adequate shelter for all. It is clear that the total supply of buildings is inelastic in the long run and the only way to sustain the stock of housing at a particular period is through repairs and maintenance. It is also important to ensure efficient and equitable systems for management and maintenance of the existing housing stock. Historically, in both public and private sectors, maintenance was seen by many as an avoidable task, which was perceived as adding little to the quality of the working environment, and expending scarce resources that could be better placed (Higher Education Backlog Maintenance Review 1998) Maintenance is war. The enemies are the triumvirate of breakdown, deterioration, and all types of unplanned events. The soldiers are the maintenance department and as many civilians as one can recruit. As maintenance leaders, we have many strategies and weapons at our disposal; some new, some old, some complex and some simple, some effective in one theater of operations and some better in another. Each strategy to consider works only with the support of the correct weapons and logistics. The RICS/ISVA Working Committee defined maintenance as “work undertaken in order to keep, restore or improve every facility, to an acceptable standard and to sustain the utility and value of the facility”. This is proactive maintenance. Fifty years ago, the challenge was to get people to identify and care about historic buildings; twenty-five years ago, the challenge was to avert redevelopment. Today, the challenge is to stop the unnecessary loss of historic buildings through neglect (Institute of Historic Building Conservation, 2000). A good manager must be willing to admit to a maintenance problem and actively pursue a solution. How can a good maintenance manager actively pursue a solution? Be a proactive, disciplined and accountable. Manage to maximize available resources, manage based on information. He should be able to give reports on production/operations and feedback from work reports (Adenuga1996).

The study aims at finding how effective maintenance practices will sustain housing stock in Nigeria through the following objectives: Investigating the causes of neglect of

maintenance responsibilities on existing housing stock; examining the importance of maintenance as an instrument for sustaining housing stock; and providing strategic approach and policies for criteria services for housing projects, guidelines for maintenance checklists and frequencies for maintenance operations on existing housing stock.

Theoretical Framework and Review

The Need for Sustaining Housing Stock

There is growing recognition of the need to preserve the existing housing stock in Nigeria as this stock has a critical role to play in addressing the need for affordable housing (Windapo, 2005).

It is also recognized that preservation of the existing housing stock will become more of an issue in the future as this stock continues to age and the economy improves and creates increased pressure for redevelopment. The limited focus on this issue to date has been attributed to a rather slow economy in recent years and limited pressure for redevelopment (Okupe, 2000). On the one hand, preserving the existing stock benefits tenants by retaining the supply of affordable housing. On the other hand, redevelopment may increase the stock of housing, but may or may not increase the stock of affordable rental housing (Onibokun, 1990). While there has been some recent activity in the construction of new housing in Nigeria, most of the units being developed are high-end rental. In this context, and given the insufficient development of new housing, the preservation of the existing affordable housing stock is critically important.

The Need for Maintenance in Sustaining Housing Stock

One of the major forces that catalyze the growth of economic, social and technological advancement of any nation is the development of maintenance culture (Celestine 1989). Our buildings (both public and private) lack adequate maintenance care or attention. It is unfortunate but, glaring fact that our buildings are in very poor and deplorable conditions of structural and decorative disrepair. They are more or less refuse dumps and natural homes for rodents and vermin (Adenuga 1999).

In spite of millions of Naira spent to erect imposing and monumental buildings, they are left, as soon as commissioned, to face premature but steady and rapid deterioration, decay and dilapidation. Maintenance is very important to preserve and enhance the life span of buildings Zubairu (1998). In Nigeria, it has become quite distressful to see the way in which many buildings are allowed to fall into a bad state of disrepair due to lack of maintenance. Many State Governments claim that it is due to lack of funds, but what is the aim of expending huge sums of money erecting such edifices if after a few years, they are allowed to become dilapidated due to lack of proper maintenance? The United Nations Centre for Human Settlements noted that in many developing countries, poor maintenance practices are the result not so much of lack of resources as of ‘’lack of workable strategies,, methodologies and techniques for effective utilization of available resources in a systematic and methodical manner. Traditionally, in the villages, people take pride in the proper care and maintenance of their houses and surroundings. With the mass rural-urban migration that came in the wake of urbanization and post-independence, this culture seems to have been lost in transit. The oil boom of the seventies made matters worse. There was a building boom and very little attention was given to the maintenance of existing stock of buildings by the government. This general lack of maintenance culture has persisted in the country’s town mainly due to the fact that Nigeria does not have a statutory maintenance policy. According to Smith (2003) there should be a law dictating the minimum maintenance requirements necessary to ensure safe and healthy buildings, services and surroundings. There should also be agents to ensure that the law is duly enforced. Best maintenance practices are actually defined in two distinct categories. There are the standards, which are the measurable performance level of maintenance execution, and then there are the methods and strategies that must

be practised in order to meet the standards. The combination of these is elements of an Integrated Planned Maintenance System classified as Maintenance Excellence.

Objectives of Building Maintenance

Oyefeko (1999) enumerated the following as the major objectives of building maintenance:

a) To ensure that the functional requirements of the facility are attained at all times.
b) To create a conducive and tenantable accommodation for owners and occupants users.
c) To enhance the quality of building structure to meet modern day requirements.
d) To prolong the life span of the building.
e) To preserve the physical characteristic of the building and associated services so as to reflect fewer breakdown and thereby reduce the probability of early failure.
f) To ensure that assets are kept at reasonable standard and at least cost.
g) To maximize the economic and financial returns from the use of the building.
h) To ensure the safety of the users/occupants.

Most people know from personal experience how difficult it is to find a reliable builder to carry out domestic repairs. The industry has many faults, including a fragmented structure, a lack of business skills, and a failure to recognize the technical capacity needed for effective repair and maintenance work.

Lives of Building

Sufficiency of the design, constructional details and the methods of building construction determines the usefulness of buildings. It is also dependant upon the way that the building is used and the maintenance policies and practice undertaken during its life (Iyagba, 2005). The life span of the individual materials and components has a contributory effect upon the life span of the building. It is not a question of how long a component will last but of how long a component will be retained. The particular circumstances of each case will have a significant influence upon component longevity. These will include the original specification of the component, its appropriate installation within the building, interaction with adjacent materials, use and abuse, frequency and standards of maintenance, local conditions and the acceptable level of actual performance by the user. The management policies used by the owners or occupiers are perhaps the most crucial factors in determining the length of the component lives.
The study of (Adenuga, 1999) concluded that the rapid deterioration of buildings and their components can be attributed to many different causes:

a) An emphasis upon initial building costs without considering the consequences of cost in use.
b) Inappropriate design and detailing of buildings and components.
c) Use of materials and components that have sufficient data on their longevity.
d) A lack of understanding of the various mechanisms of deterioration.
e) Insufficient attention given to the maintenance of the building stock.
f) Inappropriate use by owners and occupiers.

Life Cycles of Building Components

Previous research (Zubair, 1999; Oyefeko, 1999, Iyagba, 2005) identifies three main components of building and their average life spans:

a) Building shells: which include major physical elements such as structural frames, floors, the building exterior envelope and vertical transportation/services core. These have a life span of 40 to 50 years.
b) Fitting-out elements: these include ceilings, partitions and floor finishes. They have an average life as short as 5 years.

c) Building services: these include mechanical and electrical services, telecommunication and data, lighting and interior transportation systems. Their life span ranges from 5 to 25 years.

Maintenance intervals of building components

Maintenance intervals vary depending on effects of weather over time and natural decay, normal wear and tear and extent of vandalism or misuse. NBA Construction Consultants (1985), outlined average maintenance intervals for building components due to normal wear and tear. The life expectancies and maintenance intervals vary with materials as shown in the table 1 in the appendix.

Roofs**:** The NBA study, recommends that all roofs should be inspected at one or two years intervals with a checklist of potential defects. Flat roofs should be inspected annually. In areas of high pollution, inspections may need to be more frequent. The average life expectancies and maintenance cycles of some common roofing materials are as shown in the table 2 in the appendix.

On electrical installations, any wiring that is more than 35 years old is out of date and should be replaced (NBA, 1985). The expected life of wiring is 20 to 30 years. Lights should be inspected at least every six months. The expected life of lifts before refurbishment or replacement is 20 to 40 years (NBA, 1985). Suspension ropes however, have a life of only about 6 years. Lifts should be checked six months under a planned maintenance programme. Water supply, plumbing and sanitary services: Overflow pipes, taps and ball valves should be checked periodically depending on frequency of use. Bends and channels in the pipes should be inspected and cleaned yearly. Drains should be water-tested every 2 to 3 years. Soak-away pits should be emptied periodically. Air conditioners, these should be checked every six months and serviced annually.
In achieving better performance of all these components, there should be a maintenance programme. This should be determined by the maintenance Manager/ Property Manager depending on his nomenclature, preferably a Professional Builder.

Implementation Strategies

Planning the transition for the implementation of best maintenance practices is essential. Timelines, personnel assignments, documentation and all the other elements of a well planned change must be developed before changes actually begin to take place (Smith, 2003) The following list of proactive maintenance organization attributes are the significant parts of the new approach and therefore need to be addressed in the transition plan.

i. Maintenance skills training – Determine what the training is meant to accomplish. Performing a job task analysis (JTA) will help define the skill levels required of maintenance department employees. The job task analysis should be followed with a skills assessment of employee knowledge and skill levels. Analyze the gap between required skills and available skills to determine the amount and level of training necessary to close the gap.
ii. Work Order System – The work order is the primary tool for managing labour resources and measuring department effectiveness. The computerized maintenance management system will help in defining changes to, or complete restructuring of, any existing work order system. The work order will be the backbone of the new, proactive maintenance organization's work execution information input to, and feedback from computerized maintenance management system.
iii. Planned, Preventive Maintenance Tasks/Procedures – It involves development of maintenance task documentation which include standardize listing of parts, material and consumable requirements, it should identify the craft and skill level (s) required to perform the task and a frequency of performance.

iv. Maintenance Engineering Development – If the organization does not have a maintenance engineering section, one should be established. Their responsibilities in this area should include evaluating preventive maintenance action effectiveness, developing predictive maintenance techniques/procedures, performing condition monitoring, planning/scheduling, conducting investigations of failures including root cause analysis, and performing continuous evaluation of training effectiveness.

v. Establishment, Assignment and Training of the maintenance planner/scheduler – The function of the planner/scheduler is pivotal to a proactive maintenance. He must be familiar with the maintenance process, he must also be a good administrator and he must have the appropriate level of authority to carry out his role of labour usage scheduling and interfacing between many departments within the organization.

Among his responsibilities are: Provide Detailed Job Plan Instructions, determine part requirements for planned job, provide necessary drawings for jobs, ensure drawings are revised and current, arrange for special tools and Equipment, Co-ordinate Equipment downtime with production/operations. Inform production/operations of job progress etc.

- Maintenance Inventory and Purchasing Integration/Revamping – The cost of (parts) inventory is almost always an area where cost reduction can be substantial. With the help of suppliers and equipment vendors, purchasing can usually place contracts or Basic Order Agreements (BOA) that guarantee delivery lead time for designated inventory items. Begin by identifying your facility's parts, material and consumable requirements. All the inventory requirements data should be entered into the computerized maintenance management system.

- Computerized Maintenance Management System – An effective CMMS is critical to an organized, efficient transition to a proactive maintenance approach. It is a phenomenon that can impede or prevent you from ever achieving the standards of Best Maintenance Practices.

It is also a good time determined that the output data is adequate to meet each user's individual requirements.

- Management Reporting/Performance Measurement & Tracking – Hand-in-hand with CMMS review and/or upgrade is the "report generator" function. The CMMS output should be providing maintenance engineering, production/operations, purchasing, accounting and upper management with accurate, effective and useful tools for evaluation and management.
- Return on Investment (ROI) Analysis – Justification of everything in business today is based on cost. In the planning and implementation of the changes, upgrades, etc., there is need to separate the development costs from the routine and normal operating costs of the facility to determine the total cost of implementing Best Maintenance Practices. The key performance indicators are the productivity/operating cost, maintenance labour costs, maintenance material costs, inventory carrying costs, and reliability/availability data.
- Evaluate and Integrate use of Contractors – A final item to consider when incorporating Best Maintenance Practices is integrating the use of Contractors into your facility maintenance and maintenance costs for in-house performance and compare them to the costs of contracting out selected effort. This is likely to be a function of total facility size and operating costs. Some of the maintenance or maintenance engineering efforts that may be considered as potential candidates for contractor performance include; Maintenance (performance of), Capital Improvement and/or Expansion Programs, Condition Monitoring (e.g., Facility Performance Tests) etc. Any maintenance activities that do become a contractor function must still have relevant information/data collected and entered into the CMM.

Methods

For the purpose of carrying out a survey into the causes of neglect of maintenance responsibilities and providing a strategic approach for its best performance, a questionnaire focused on some maintenance officers of some selected government institutions, ministries, parastatals and occupiers of selected public estates within Lagos Metropolis was designed to obtain the data required. The simple random sampling technique was adopted. Thirty (30) of the well completed and returned questionnaires which is about 75% of the total administered generated a data bank of information required. The primary data included the responses to the questionnaires and the findings from personal interviews.

The secondary data comprised theories, research findings through internet, journals and books.

Methods of Data Analysis

The "mean score" method was used to established the causes of neglect of maintenance responsibilities. To facilitate the analysis of the responses, the following numerical values were assigned to the respondents' ratings.

- Strongly Agree (A) -------- 5
- Agree (B) -------- 4
- Undecided (C) -------- 3
- Disagree (D) -------- 2

The four-point scale was used to calculate the mean score for each factor, which was then used to determine the relative ranking by assigning ranks to the mean scores with low mean scores assigned low ranks.

Data Analysis and Discussion

Table 3 indicated that 76.7% of the respondents have maintenance department. This represents a clear majority of the population and thus suggests that maintenance value of buildings. The Engineers occupy at least 40% of the entire population studied with 53.3% respondents failing to disclose the types of staff engaged for maintenance activities. (table 4) The result suggests that Civil Engineers are the dominant of maintenance department in public sectors

From table 5 the fact that 26.7% of the maintenance officers have BSc. or MSc. shows that better performances are expected for maintenance operations. Majority of the maintenance departments studied have the staff strength of 1-5 (53.3%) personnel (table 7) and Engineers dominated the preparation of maintenance programmes and budgets, which do not give a good judgement on maintenance operations,

Tables 8 indicated that, (53.3%) do have budgetary allocation for maintenance programmes. This means the public officers know the importance of maintenance in retaining the economic values of government properties. From table 9, majority declined to give the confirmatory statement on the adequacy of funds but from personal interview, it was gathered that most of them do not have adequate funds for maintenance repairs.

Table 10 also indicated that (83.3%) of government ministries and parastatals have maintenance awareness by making a schedule for periodic inspection of key building elements for functionality. This tends to guide against the risk of total breakdown before effective repairs. From tables 11, the monthly and three months periodic interval commanded highest population which means many public buildings have a planned maintenance programme and also from table 12, they also have maintenance policy for periodic renewal/evaluation with (56.7%). It is observed that most of the maintenance repairs are executed through contracting procurement systems. (table 13) .

The table 14 in the appendix represents the respondents ranking of twenty-one (21) significant reasons for neglect of maintenance responsibility. The result shows that lack

of discernible maintenance culture in the country, establishments de-emphasizing training, retraining and continuing education on effective maintenance are the major reasons for neglect of maintenance responsibilities. Other reasons such as absence of long-term arrangements for the supply of essential service parts for replacement, quality of management in an organization, with indiscipline and ignorance on the part of users are also found to have contributed to the neglect of maintenance responsibilities.

Summary of Findings

From the sample studied, majority of them have maintenance department dominated by Civil Engineers. The Engineers prepare the maintenance programmes and the budgets. About 53.3 % of the samples studied have staff strength between 1-5 personnel. They all have budgetary allocation for maintenance programmes but found to be inadequate. Although they engage themselves in periodic inspection of the key building elements based on the maintenance policy for periodic renewal/ evaluation, the implementation do experience some setback due to inadequacy of fund. Most of their maintenance repairs are executed through contract procurement systems.

The study also has highlighted the numerous reasons for neglect of maintenance responsibilities in Lagos State especially as it relate to buildings. Among twenty-one (21) reasons identified, lack of discernible culture, de-emphasizing training, retraining on effective maintenance by establishments, inability to provide resources for maintenance operations, indiscipline and ignorance on the part of users of both public and private buildings, a retrogressive and negative attitudes of the public towards maintenance were the most dominant factor responsible for neglect of maintenance responsibilities.
From the sample studied, majority of them do provide budget for maintenance operations but the allocation was found to be inadequate. They carried out periodic inspections of their key building elements based on an existing maintenance policy guiding the periodic renewal/evaluation.

Policy Statement for Consulting Services for Housings Projects

Guidelines for Maintenance Checklists

In reporting deficiencies, the maintenance staff or handyman should be guided by the following aide memoirs. It should be noted that the guides that are given here are not intended to be exhaustive. They will, however, focus inspection on the critical areas.

Spaces/Materials	Good	Bad
Washrooms and Toilets ● Check to see if walls are cracked ● Where the walls are made of rubble stone see if the mortar is in good condition ● Check to see if items such as soap holders and toilet paper holders are in place and are in working order		
Corridors and Rooms ● Examine the floors to see if the concrete has been damaged in any way so that persons walking in the corridors or rooms may trip ● Check to see if the walls are damaged and need repairing		
Ceilings, Interior Roofs, and Canopies ● See if the ceilings and the undersides of the roofs and canopies have any watermarks which indicate leaks in the roof ● See if any timber supports are rotten ● Where the roof supports are of steel, check to see if there is any rust ● See if any ceiling tiles need replacing		
Plumbing ● Check to see if there is any water on the floor ● If there is, examine the wash basin to see if it is plugged ● Examine the WC to see if the bowl is cracked		

● Check to see if the toilet seat cover is broken ● See if the flush handle or pull chain is broken ● See if the toilet bowl is fixed properly to the floor so that it does not rock when being used ● See if the sewer pipe is properly fixed to the toilet and that there is no leaking at the joint.		
Electricity ● See if all light bulbs are working and that all are in place ● See if the wall plates are in good condition ● See if the wall switches or pull switches are working ● See if wall outlets are working		
Windows ● See if the windows can close securely ● See if the window operators are in good condition and are working ● See if the bolts and locks are in working condition ● See if the timber surrounding the windows is rotten and should be replaced ● See if the windows leak even when closed		

Spaces/Materials	**Good**	**Bad**
Doors and Frames and Partitions — See if the doors can close properly — See if the bolts and locks are in place and are working — See if the door frame is in good condition and that the timber is not rotten — Where the door is a wood door (brace and batten) see that the door has not warped — Check the partitions to see if the walls are in good condition — Report any loose mortar in a rubble wall — Report any cracked wall		
Roof and Gutters — Check roofs for leaks — Check gutters for holes — Check a timber fence, check for rotten timber		
Water mains — Check ground to see if there are any wet spots which would indicate a leaking water main — See if the water main is properly buried beneath the ground, or is well protected by concrete		
Septic tank — Check to see if the tank has been cleaned in the last three years — See if the access covers fit properly, are in good condition and can be removed for cleaning — See if the holders for the covers will cause people to trip. The holder should be recessed with just enough room for a pickaxe blade to get under the holder — See if the inlet pipe is firmly fixed to the tank and that there is no leak — Where there is a soak away check to see the pipe to the soak away is firmly bedded — See if there is any odour around the tank. If there is, the tank needs cleaning or another soak away should be dug — Where there are tile fields, check to see if the pipes (tiles) are exposed They should be well below ground level — See if the tiles are working and that there is no water on the ground around the pipes		

Erosion near Structures — Examine the ground around the buildings to see if the rain water has removed any material – soil or stones — Check around the pipes to see if the pipes that were buried are still properly buried — Check around telephone or electricity poles on the property to see whether the rain water has removed soils around the bottom of the poles		

Facility Management

— The common parts of the air-conditioner to be noted or known
— Maintenance Of Air-conditioners
— Front Panel
— Grille
— Air Filter usually behind the grille
— Up/Down air flow adjustment louvers
— Left/Right air flow adjustment louvers
— Cabinet
— Ventilation lever
— The Control Panel
— Power Cord
— Compressor which is the main engine and
— Fan Motor

Cleaning And Maintenance

Cleaning the Filter:

— Turn off the unit before performing any cleaning or maintenance.
— If the filter is clogged with dust, the amount of airflow will be reduced, resulting in poor cooling performance.
— The filter should be cleaned every 10 days.
— At the beginning of every cooling season or after a long period of inactivity, clean the filter before starting the unit.
— To remove dust from the filter, use a vacuum cleaner or wash it with clean water.
— If the filter is very dirty, wash it with detergent and rinse carefully with clean water.
— Dry the filter with a soft cloth.
— Do not expose the filter to heat or dry in direct sunlight.
— Never operate the unit without installing the filter and the grille as this may result in serious damages to the unit.

Cleaning of the Front Panel, Grille And Cabinet

— To clean the front panel, grille and cabinet, wipe with a soft, dry cloth or with a cloth moistened with a mild soap.
— Rinse carefully by wiping with a damp cloth then dry completely.
— Avoid splashing the unit with water.
— Excess water can damage electrical installation and result in damage.
— Never use harsh chemicals or abrasive cleaners on any parts of the unit.
— To avoid damage to the unit, do not use hot water over 50^{o}C when cleaning

Fan Motor and Compressor

— These are the very vital parts of the Air-Conditioner, Oiling of the compressor and Fan Motor is unnecessary.
— The compressor is permanently lubricated and it hermetically sealed.
— The fan motor is life-time sealed and does not require oiling. Call in specialists to test at the fan motor and or the compressor if it is a suspected major problem.

Before Calling For Service

- If the Air-Conditioner does not operate properly, please check the following items before calling for service.
- If the Air-conditioner does not operate at all, then check.
- Is the power cord loose or disconnected?
- It the fuse blown or the circuit breakers tripped?
- Did you restart the unit before 3 minutes after power failure?
- If the power was off for less than 3 minutes and you restart the Air-conditioner before 3 minutes, a protective devise may cause the air conditioner to shuff, preventing coding operation for some minutes (20 minutes) If the Air-conditioner does not cool properly
- Is the selector set for Fan mode?
- Cooling will not be conducted in Fan mode, Change the selector setting to LOW, MED or HIGH.
- Is the filter clogged with dust?
- A dirty filter can cause the cooling coils to freeze.
- If this happens, clean the filter and replace.
- Rave the Air conditioner on the FAN setting until all the ice disappears.
- Is the THERMOSTAT set properly?
- If your room is too warm, adjust the THERMOSTAT knob to a lower cooling setting.
- Is the VENTILATION lever in the RIGHT (OPEN) operation?
- The lever should be in the LEFT (CLOSED) position during cooling.
- Is the window exposed to direct sunlight?
- Close curtains or blinds to minimize solar energy heating in the room
- Are the windows or doors open?
- Close all windows and doors for maximum cooling.

Frequencies for Maintenance Operations

The table 15 in the appendix suggests periodic inspections of key building elements, the types of staff and number of operatives required for an effective implementation.
The tables are presented covering:(a) the building interior, (b) the building exterior; (c) the compound.
The following abbreviations are used in the tables:

Operator

C: General cleaners
MS: Maintenance Staff
BS: Building Superintendent
BA: Building Administrator
G: Gardener

Notes:

1. For *frequency* the maximum period is given
2. For *operator* the person named is the one responsible for seeing that the operation is carried out.

Conclusion

Building are man-made assets which require regular maintenance if they must contribute to the economic development The study has revealed that one of our greatest economic and social problems, as a nation is the general absence of a maintenance and thrift culture. There is unpardonable neglect and laxity in all spheres of our national life.
However, a number of reasons have been identified in contemporary maintenance practices which cause neglect of maintenance responsibilities and they are contained in the following conclusions: lack of discernible maintenance culture in the country, establishments de-emphasizing training on effective maintenance, no long-term

arrangements being made for the supply of essential parts for replacement. Lack of sound maintenance management, indiscipline and ignorance on the part of users and the general tendency to execute work only when it becomes a matter of urgency. The negative and general retrogressive attitudes of the public towards maintenance, absence of efficient inventory systems, non-adoption of appropriate maintenance cycles were also identified as reasons for neglect. Others are the absence of a form of planned maintenance programme, attention not given to our level of technology, cultural and environment during designs. Non-involvement of maintenance experts during designs and development especially is some complex designs have also been identified as a contributing factor.

The paper also revealed that majority of the population studied provides budgets for maintenance operation but found to be inadequate. They carried out regular periodic inspections on their key building elements based on maintenance policy for periodic renewal/replacement. The implementations do suffer setback due to inadequacy of funds. Although majority has maintenance department dominated by Civil Engineers, these Engineers are also responsible for the preparation of maintenance programmes and budgets. This does not give a good judgment on maintenance operations.

In connection with the problems identified above, the study therefore suggested a proactive approach to maintenance by providing guidelines for maintenance checklist operations on key building elements. It also provides frequencies for maintenance operations, the types of staff and the number of operatives required for effective implementation. As a matter of policy, every individual especially those in the building industry should preserve the quality of existing dwellings and neighborhoods so that people will find our community a healthy, safe and attractive place to call home today and into the future. We should seek a variety of housing options that blend with the character of the surrounding community and the socioeconomic needs of people who live and work here. There is a need to encourage housing development that provides for “live, work, and play” relationships as a way to reduce traffic congestion, encourage economic expansion and increase overall quality of life for our residents. Lastly, we should encourage the increased availability and integration of a variety of housing that supports flexibility, mobility, independent living, and services for all age groups and those with special needs.

Recommendations

The major emphasis for actively pursuing solutions for maintenance ineffectiveness should be on proactive thinking. Adopting a proactive approach to maintenance will improve maintenance effectiveness drastically and more rapidly than instituting an aggressive programme of maintenance effectiveness improvement within the confines of the organizational and cultural environment of an existing, predominantly reactive maintenance programme. An effective computerized maintenance management system should be established for efficient transition to a proactive maintenance approach. Every organization should have adequate budgetary allocations, maintenance policy, and periodic inspections of key building elements. There should be a reformation of the building industry and this should include the enhancement of the role of trade organization, the provision of more specialized training opportunities, and a system of voluntary licensing of firms, backed up by regular inspections of work to ensure maintenance of standards. It is essential that any reforms be accompanied by measures to persuade home-owners to make greater use of reputable builders, even if this costs them more. In the long term, better value for money will be obtained from good quality work. A combination of incentives (such as government-backed warranties for work by licensed builders) and compulsion (for example, by stronger enforcement of regulations) will be required to achieve this. ‘Cowboy’ firms flourish not just through poor training and organization within the building industry but also because home-owners and the government allow them to. A comprehensive effort is needed to produce the quality of output necessary to safeguard the nation’s housing stock into twenty-first century. “Best Maintenance Practices” are bench marking standards, but these are real, specific,

achievable and proven standards for maintenance management that have made many maintenance departments more efficient, having reduced operating costs, improved reliability and that have increased morale within the organization.

The paper also revealed that majority of the population studied provides budgets for maintenance operation but this was found to be inadequate. There is need to reform the industry and therefore educate consumers in order to boost standards and increase the volume of nations' investment.

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Appendix

Table 1: Life expectancy of floor finishing materials

MATERIAL	LIFE (YEARS)	MAINTENANCE INTERVAL (YEARS)
Carpet	10	3 – 4
PVC tiles	15 – 20	5
Linoleum	15 – 25	5
Woodblock	45 – 60	Polish yearly, re-sand and re-

		seal every 10 days
Woodstrip	60 – 65	"
Terrazzo	50 – 65	9 – 10
Granolithic	50	9 – 10
Quarry tiles	50 – 65	6 – 7

Source: NBA Construction Consultants (1985)

Table 2: Life expectancy of roofing materials

MATERIAL	**LIFE (YEARS)**	**MAINTENANCE INTERVAL (YEARS)**
Built-up felt	15 – 20	3 – 4
Asphalt	20 – 60	6 – 7
Clay tile	25 – 70	4 – 5
Concrete tile	20 +	Very durable
Asbestos cement	26 – 40	Generally 6 – 7 depends on air pollution
Zinc		ditto
Aluminium		ditto

Source: NBA Construction Consultants **(**1985)

Table 3: Organizations with maintenance department.

		Responses	Percentage(%)
(i)	Undecided	2	6.7
(ii)	Yes	23	76.7
(iii)	No	5	16.7
	Total	30	100

Table 4: Professional Staff that make up Maintenance Department.

		Responses	Percentage (%)
(i)	Civil Engineers	12	40.0
(ii)	Estate Surveyors	2	6.7
(iii)	Builder	6	20.0
(iv)	Quantity Surveyor	5	16.7
(v)	Neutral	5	16.67
	Total	30	100

Table 5: Qualification of Maintenance Officers.

		Responses	Percentage (%)
(i)	HND	1	3.3
(ii)	BSc	8	26.7
(iii)	MSc	8	26.7
(iv)	PhD	2	6.7
(v)	Neutral	11	36.7
	Total	30	100

Table 6 : The Professionals responsible for preparing Maintenance Programme/Budget.

		Responses	Percentage (%)
(i)	Estate Surveyor	1	3.3
(ii)	Engineer	10	33.3
(iii)	Builder	3	13.3
(iv)	Quantity Surveyor	1	3.3
(v)	Neutral	14	46.7
	Total	30	100

Table 7: Staff Strength in Maintenance Department.

		Responses	Percentage (%)
(i)	1-5	16	53.3
(ii)	6-10	9	30.0
(iii)	11-20	1	3.3
(iv)	Above-20	2	6.7
(v)	Neutral	2	6.7
	Total	30	100

Table 8: Organizations with Budgetary allocation for Maintenance.

		Responses	Percentage (%)
(i)	No	12	40
(ii)	Yes	16	53.3
(iii)	Neutral (Neither Yes or No)	2	6.7
	Total	30	100

Table 9: Adequate of Maintenance Budget

		Responses	Percentage (%)
(i)	No	6	20.0
(ii)	Yes	4	13.3
(iii)	Neutral	20	66.7
	Total	30	100

Table 10: Periodic Inspection of Key Building Elements

		Responses	Percentage (%)
(i)	No	2	6.7
(ii)	Yes	25	83.3
(iii)	Neutral	3	10.0
	Total	30	100

Table 11: Time for Periodic Inspection

		Responses	Percentage (%)
(i)	Daily	2	6.7
(ii)	Weekly	4	13.3
(iii)	Monthly	8	26.7
(iv)	Three Months	9	30.3
(v)	Six Months	1	3.3
(vi)	Neutral	6	20.0
	Total	30	100

Table 12: Organizations with Maintenance Policy for Periodic Review/Renewal

		Responses	Percentage (%)
(i)	No	8	26.7
(ii)	Yes	17	56.7
(iii)	Neutral	5	16.7
	Total	30	100

Table 13: Procurement Method for Maintenance Repairs

		Responses	Percentage (%)
(i)	Direct Labour	4	13.3
(ii)	Labour Only	4	13.3
(iii)	Contracting	10	33.3
(iv)	Neutral	12	40.0
	Total	30	100

Table 14: Responses To The Ranking Of Top 21 Significant Reasons For Neglect Of Maintenance Responsibilities

S/NO	**CAUSES**	**NUMBER OF RESPONDENTS SCORING**				**MEAN SCORE**	**RANKS**
		5	4	3	2		
1.	Lack of discernible maintenance culture in the country	19	7	3	1	4.467	1
2.	Establishments that de-emphasize training, retraining and continuing education can hardly possess an effective maintenance	17	11	1	1	4.467	1
3.	No long-term arrangements are made for the supply of essential parts for replacement.	16	9	1	4	4.379	3
4.	The quality of management of a given organization influences the scale of efforts, extent of facilities and resources for maintenance operations.	14	14	1	1	4.367	4
5.	Indiscipline and ignorance on the part of users often lead to persistent breakdown	16	10	2	2	4.333	5
6.	The general tendency is to execute work only when it becomes a matter of urgency.	15	11	2	2	4.300	6
7.	Attitude of the public towards maintenance is negative and generally retrogressive.	15	9	3	2	4.276	7

8.	No attention is given to our level of technology, our cultural background and environment during design.	15	10	3	2	4.267	8
9.	Lack of data and poor information processing handicap effective maintenance	12	13	4	1	4.200	9
10.	Absence of efficient inventory system leads to frequent shortage of materials and spare parts.	12	14	2	2	4.200	10
11.	No adoption of appropriate maintenance cycles for building maintenance.	9	19	1	1	4.200	11
12.	There is absence of a form of planned maintenance programme	13	11	2	3	4.172	12
13.	Unavailability of funds to procure spare parts limits the potentials of an establishment to undertake successful maintenance programme.	16	6	1	6	4.103	13
14.	In most cases, maintenance consideration that are purely technical decisions are taken by non experts due to political influence.	14	9	3	4	4.10	14
15.	Natural deterioration due to age and environment.	12	10	3	4	4.034	15
16.	There's use of poor quality components and materials for building execution.	12	9	2	5	4.000	16
17.	There is complexity in design and non-involvement of maintenance experts during design stage.	10	11	3	5	3.897	17
18.	Some establishments are unwilling or reluctant to support innovations	7	15	4	4	3.833	18
19.	Lack of adequate funds and interest in the area of research and development.	7	13	4	6	3.700	19
20	Obsolete equipment and project designs imposed owing to the preponderance of undue political influence.	17	11	3	9	3.533	20
21.	There is lack of skilled manpower to undertake maintenance work especially in those buildings designed and constructed by expatriates.	7	7	2	9	3.480	21

Analysis of sampled data, 2009
Strongly Agree --5; Agree ---4; Undecided ----3; Disagree---2

Table 15a : Building Interior .

Spaces/Materials	Frequency	Operator
Washrooms and Toilet		
— Inspect and report deficiencies	- Daily	- C/MS
— Wash floors, toilet bowls, urinals, wash basins with disinfectant and deodorant	- Daily	- C
— Order replacements	- Immediately	- SS/SA
— Replace broken elements	- Quarterly	- MS
— Repair	- Immediately	- SS
— Paint	- Annually	- MS
Corridors and Classrooms		
— Inspect and report deficiencies	- Daily	- C
— Wash walls	- Weekly	- C
Ceilings, Interior Roofs, Canopies		
— Inspect and report deficiencies	- Annually	- MS
— Repaint	- Every 4 years	- MS
Laboratories and other Technical Areas		
— Clean all counters, floors and walls	- Daily	- MS
Plumbing		
— Inspect and report deficiencies	- Daily	- MS
— Repair or replace defective pieces	- Immediately	- SS
Internal Communication System		
— Inspect all internal communications to ensure that the system is functioning properly and report defects	- Quarterly	- SS
Electricity		
— Inspect electricity wiring on a room-by-room basis and report deficiencies	- Quarterly	- MS
Furniture		
— Repair or replace broken elements	- Annually	- MS

Table 15b : Building Exterior

Spaces/Materials	Frequency	Operator
Wood		
— Inspect panels, louvers, railings and report deficiencies	- Annually	- MS
— Replace all broken wood louvers	- Daily	- BS
— Replace other damaged elements	- Quarterly	- SS
— Clean and paint marked surfaces	- Annually	- MS
Windows		
— Inspect and report deficiencies	- Daily	- MS
— Remove broken glass louvers or panes (see above also)	- Immediately	- MS
— Order replacements for broken glass and other elements	- Immediately	- BS
— Replace broken elements	- Quarterly	- MS
— Grease and oil louvers operators or handles	- Annually	-MS
— Replace broken wire-mesh grills	- Quarterly	- BS/MS
— Wash windows	- Quarterly	- C/MS
Doors and Frames and Partitions		
— Inspect and report deficiencies	- Quarterly	- MS
— Oil hinges etc	- Annually	- MS
— Replace defective and broken hardware	- Immediately	- BS
— Repair or replace defective doors and/or frames	- Immediately	- BS
Stairs and Balconies		
— Sweep stairs and balconies	- Daily	- C
— Wash stairs, walls and rails	- Quarterly	- C
— Clean metal work of rust and coat with primer and paint	- Annually	- MS
— Sand and paint wood railings or posts	- Every 2 years	- MS
Roofs and Gutters		
— Inspect and report deficiencies	- Annually	- MS
— Repair and replace roof sheets and gutters as required	- Weekly	- BS
Metal Panels		
— Inspect	- Annually	- MS
— Wash and remove graffiti	- Annually	- MS
— Clean rust and repaint	- Every 2 years	- MS

Table 16: Frequencies for Maintenance Operations Compound

Spaces/Materials	Frequency	Operator
Gardening		
— Clean flower beds	- Weekly	- G
— Watering and fertilize plant	- Daily	- G
— Remake plant beds	- Quarterly	- G
— Prune plants, trim hedges	- Monthly	- G
— Grass playing fields	- As required	- G
— Cut grass	- Weekly	- G
Fence		
— Inspect and report deficiencies	- Quarterly	- MS
— Repair	- Every 2 years	- MS
— Paint	- Every 2 years	- MS
Walkways and Courtyards		
— Sweep	- Daily	- C
— Clear litter and rubbish	- Daily	- C
Drainage Ditches		
— Clean routinely	- Weekly	- C
— Clear blockages caused by excessive rain	- Immediately	- MS
— Repair damaged drain	- Annually (August)	- MS
Water Mains		
— Inspect and report deficiencies	- Quarterly	- MS
— Maintain earth cover	- Quarterly	- MS
— Repair breaches/leaks	- Immediately	- BS
Septic Tank		
— Inspect and report deficiencies	- Annually	
— Clean and flush out	(August)	- MS

— Repair	- Every 4 years - Immediately	- MS - BS
Erosion near Structures — Inspect and report deficiencies after heavy rainfall — Return soil, grass area, redirect water source — Repair eroded area	 - Quarterly - Quarterly - Immediately and as required	 -MS - MS - BS
Rubbish Bins — Empty drums and burn (or carry away) rubbish — Inspect and replace bins if necessary	 - Daily - Annually	 - C - MS

Source:Whitlock Brothers (2001) and Iyagba (2005)